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Jumping to Conclusions: A Series of Integrated Trap Integrity Studies from the Australian North West Shelf with Unexpected Outcomes

Trap integrity represents a critical risk to exploration success on the Australian North West Shelf (NWS), with a large number of residual oil columns recognised below the oil water contact in oil fields from the region. These indications are commonly interpreted to represent varying degrees of trap breach, mostly due to fault reactivation with attendant hydrocarbon leakage. A series of high-resolution integrated studies undertaken to examine the cause of hydrocarbon loss in a selection of NWS fields has produced some surprising outcomes. Combining innovative techniques for describing hydrocarbon fill history with 3-D structural restoration methods to describe trap evolution through time, a unique insight into the processes that modify hydrocarbon columns after they first fill is obtained. In some instances the assumed link with fault seal failure can be clearly supported and good agreement can be reached between the interpreted fluid-flow histories, the structural history and a range of deterministic and empirical methods for predicting seal potential. However, in many cases these detailed examinations have revealed that processes other than trap breach can adequately account for the presence of the residual oil column. Modification of the structural geometry after initial charge has a profound impact with changing spill points, rather than trap integrity, often exerting the main control on the volume of hydrocarbons that can be retained. Differentiating between these causes of fluid loss has fundamental implications for understanding why traps fail and in turn limits erroneous trap integrity conclusions, resulting in better predictive models and ultimately increased exploration success.